NPL___ ADONIS___ MIC___ BioT___Main__NO__Vol NO ✓ NOS___CKCite__Dup__Int ✓/C 9/29

STIC-ILL

From: Ngo, Tamthom 1624
Sent: Thursday, September 28, 2006 5:15 PM
To: STIC-ILL
Subject: FOR APPLN 10/ 687,421

604121

Hi,

I need the following article for appln 10/ 687,421:

TITLE: Vilsmeier-Haack reaction. V. Reaction of 2-methyl-4-quinazolone derivatives and a new synthesis of pyrazolo[5,1-b]quinazolones

AUTHOR(S): Pandit, R. S.; Seshadri, S.
CORPORATE SOURCE: Dep. Chem. Technol., Univ. Bombay, Bombay, India

SOURCE: **Indian Journal of Chemistry (1973), 11(6), 532-7**
CODEN: IJOCAP; ISSN: 0019-5103

Please deliver article to Ex. Tam Truong, AU 1624, mail box in Rem. 5C18.
Any question, please call Ex. Truong @ x 20676.

Thank you.

20925769

Indian Journal of Chemistry
Vol. 11, June 1973, pp. 532-537

Studies on the Vilsmeier-Haack Reaction: Part V—Reaction of 2-Methyl-4-quinazolone Derivatives & a New Synthesis of Pyrazolo[5,1-*b*]quinazolones

R. S. PANDIT & S. SESHADRI
Department of Chemical Technology, University of Bombay, Bombay 19

Received 14 February 1972; accepted 1 November 1972

The 2-methyl group in 2-methyl-3-phenyl-4-quinazolone (I) has been found to undergo diformylation by the Vilsmeier reagent to give dialdehyde (III). III on treatment with hydroxylamine, hydrazine and phenylhydrazine affords the related 3-phenyl-4-quinazolone derivatives with different heterocyclic systems in the 2-position. On treatment with PPA, III undergoes cyclization giving 12-ketoquino[2,1-*b*]quinazoline-6-carboxaldehyde (XII). Vilsmeier-Haack reaction on 2-methyl-3-amino-4-quinazolone (XIII) leads to the formation 3-formyl pyrazolo-[5,1-*b*]quinazolone (XV). Various derivatives of XV have also been prepared in order to investigate the fluorescence properties. Vilsmeier-Haack reaction on 2-methyl-3-acylamido-4-quinazolone also gives the same aldehyde (XV) with the loss of acyl residues. 2-Methyl-3-anilino-4-quinazolone reacts with the Vilsmeier reagent to give 1-phenylpyrazolo[5,1-*b*]quinazolone.

IN an earlier communication[1], the Vilsmeier-Haack reaction on 2-methylbenzoxazole and the various synthetic uses of the reaction products have been discussed. The present paper describes the application of the Vilsmeier reaction to 2-methyl-4-quinazolone derivatives.

The 2-methyl group in 2-methyl-4-quinazolone is known to undergo Mannich reaction and to form ethylenic compounds with aromatic aldehydes[2] and it was not unlikely that it could also react with the Vilsmeier reagent. In view of the known pharmacological activity of several quinazolones[3] it was of interest to study the Vilsmeier reaction on 2-methyl-3-phenyl-4-quinazolone (I)[4] and to utilize the reaction product for further synthetic work.

The Vilsmeier-Haack reaction on I was performed under usual conditions and the expected acrolein derivative (II) was obtained in excellent yield. The structure of II was established by elemental analysis, NMR and IR spectra and by its ready conversion with hot alkali to the corresponding malonaldehyde derivative (III). The NMR spectrum of II in $CDCl_3$ (values in τ-scale) showed signals at 7·0 [$-N-(CH_3)_2$], 3·4 ($=CH$-$N-$) and 1·4 (CHO) besides signals due to aromatic protons. The position of the aldehyde proton signal is interesting since it is at slightly higher field compared to similarly constituted acroleins, e.g. acrolein from 2-methylbenzoxazole[1], which shows the aldehyde proton signal at 0·4. This disparity may be due to the disposition of the aldehyde group towards 3-phenyl substituent which in turn is orthogonal to the quinazolone system due to steric factors. Thus the aldehyde proton will be in the shielding region of the benzene ring current. The IR spectrum was also in agreement with the structure II indicating the presence of vinylogous amide structure in addition to the quinazolone carbonyl absorption.

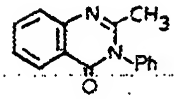
The acrolein (II) and the malonaldehyde (III) reacted with hydroxylamine, hydrazine and phenylhydrazine to yield the corresponding heterocyclic derivatives. The structures of these products were confirmed by the elemental analysis and their characteristic chemical properties. Treatment of the isoxazole (IV) with alkali gave the cyanoaldehyde (VII) as shown by its solubility in alkali and characteristic strong absorption at 2220 cm^{-1} in its IR spectrum. Reaction of VII with hydrazine and with phenylhydrazine in acetic acid gave the respective aminopyrazoles VIII and IX, as shown by their ready solubility in dilute hydrochloric acid and by their elemental analysis.

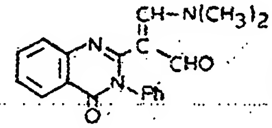
Reaction of II or III with formamide, however, failed to yield the desired pyrimidine. The product obtained on brief refluxing with formamide proved to be basic in character, thus ruling out the expected pyrimidine structure (X). Longer heating, however, led to intractable products arising as a result of rupturing of the quinazolone ring. However, reaction of II with benzamidine gave 2-phenyl derivative of X.

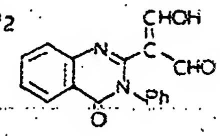
Although hydrozinolysis of 3-substituted quinazolones have been reported[5] attempts to convert the pyrazoles V and VI into corresponding 3-aminoquinazolone derivatives by reaction with hydrazine hydrate under different conditions failed. It is difficult to assign valid reasons for this failure in the present case.

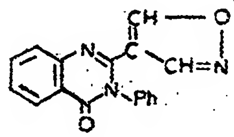
The malonaldehyde (III) was also reacted with different amines, viz. N-methylpiperazine, morpholine and aniline, with a view to investigating the pharmacological properties of the derived aminomethylene derivatives (XIa-c).

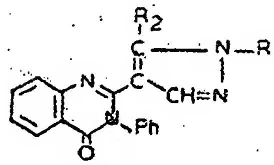
Another interesting synthetic use of the malonaldehyde III was its conversion by polyphosphoric acid into a tetracyclic aldehyde (XII, positive DNPH test). IR spectrum of the compound showed the aldehyde carbonyl at 6·05 μ in addition to the quinazolone carbonyl at 5·88 μ thus confirming that cyclization did occur. Thus we have a new route for the synthesis of this type of tetracyclic system which has been synthesized earlier[6] from 2-chloroquinaldine and anthranilic acid.

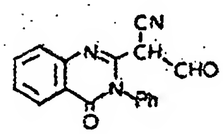

I

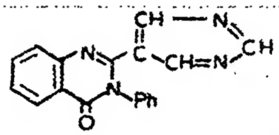

II

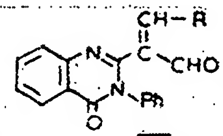
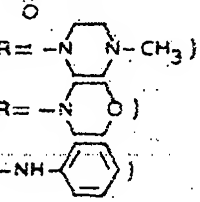

III

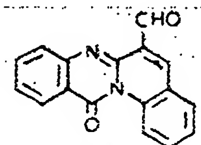

IV


V (R_1=H, R_2=H)
VI (R_1=Ph, R_2=H)
VIII (R_1=H, R_2=NH_2)
IX (R_1=Ph, R_2=NH_2)


VII


X

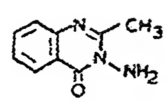


XIa (R= –N N–CH_3)
XIb (R= –N O)
XIc (R= –NH–)

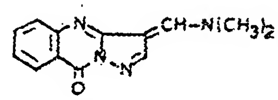

XII

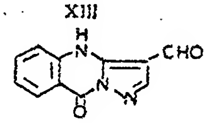
Vilsmeier reaction has been extended to 2-methyl-3-amino-4-quinazolone (XIII) and its derivatives with a view to synthesizing the pyrazoloquinazolone system (XV). Such a reaction of compounds containing active methyl group *ortho* to an amino group has been shown to occur in the case of 2-methyl-3-aminopyrazine[7].

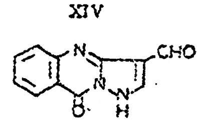
Reaction of XIII with the Vilsmeier reagent under the usual conditions gave an unstable amidine (XIV) which could not be subjected to elemental analysis. It showed the expected chemical properties, viz. it was readily soluble in dilute acid, hydrolysed by hot alkali to aldehyde (XV) and reacted readily with *p*-chloroaniline to yield the anil (XVIIa).

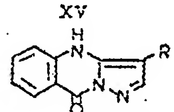
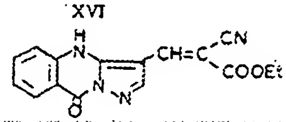
The aldehyde (XV) could also be obtained drectly from the reaction mixture by hydrolysis with hot alkali and acidification. The structure was supported by elemental analysis and its ready solubility in aq. akali, a characteristic property of such aldehydes (e.g, indole-3-aldehydes[8]). The NMR spectrum in DMSO showed signals at 0·1 (*s*, C*H*O), 1·65 (*s*, 2-*H*), 1·78 (doublet with slight splitting due to *meta*-coupling, *J*=8 Hz, 8-*H*), 2·22 slightly split doublet, *J*=6 Hz, 5-*H*), the low field portion of this doublet (2·17) is considerably higher than the high field portion indicating that another proton signal is hidden within this (probably the


XIII


XIV


XV


XVI



XIX

XVa (R= –CH=S)
XVII (R= –CH=NOH)
XVIIa (R= –CH=N–C_6H_4–Cl)
XVIIb (R= –CH=N–C_6H_4–NO_2)
XVIIc (R= –CH=N–$(CH_2)_3$–$N(CH_3)_2$)
XVIII (R= –CN)

—N-*H* proton). This is confirmed by the integration. The other two aromatic protons appeared as a complex multiplet centred around 2·67. The solubility of the compound was very low and hence on addition of D_2O crystallization occurred preventing further NMR studies. The low field position of the signal due to the 5-H proton indicates that the compound has the structure XV, the deshielding of about 0·5 ppm being caused by the lone pair of electrons on the *peri* nitrogen. This is similar to the chemical shift observed for the 5-H proton in a compound of similar structure (XXIII) described later. The tautomeric form (XVI) was first considered on the basis of fluorescence studies (unpublished data) and also on the strength of the IR evidence (quinazolone carbonyl[8] at 5·88 μ) which may be taken as an indication that there is no hydrogen bonding group adjacent to the carbonyl group. However, the NMR evidence seems to be more reliable and structure XV is, therefore, used here.

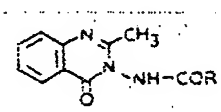
3-Thioformylpyrazolo[5,1-*b*]quinazolone was prepared by subjecting 2-methyl-3-amino-4-quinazolone (XIII) to the Vilsmeier reagent and working up the reaction with sodium hydrogen sulphide. The structure was confirmed by the elemental analysis.

The pyrazoloquinazolone aldehyde was found to be intensely fluorescent in UV light and daylight. In view of the importance of such fluorescent substances as optical whiteners it was imperative to prepare other derivatives of this system in order to study their fluorescence behaviour. Thus the nitrile (XVIII) was prepared via the oxime (XVII).

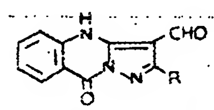
The nitrile was found to be more strongly fluorescent than the aldehyde. The aldehyde was also condensed with different amines to give the corresponding Schiff's bases XVIIa-c in order to study their colour or fluorescence behaviour. Thus the aromatic derivatives XVIIa and XVIIb were found to be deep yellow in colour changing to colourless in acid. The aliphatic derivative XVIIc was found to be fluorescent in UV light.

The aldehyde (XV) was also reacted with ethyl cyanoacetate to obtain the corresponding condensation product (XIX) which was found to be deep yellow in colour and did not show any fluorescence.

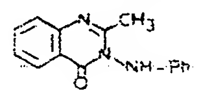
The strong fluorescence of the aldehyde (XV) and the nitrile (XVIII) prompted us to look for more examples of such fluorescent substances and in particular to study the effect of introducing substituent in the fused pyrazole ring on the fluorescence properties of the derived substances. Accordingly, the acetamido (XXa) and the benzamido (XXb) derivatives were prepared and submitted to the Vilsmeier reaction in the hope of obtaining the corresponding substituted products XXIa and XXIb via the intermediate XXVa and XXVb. However, it was found that the product of the reaction in both the cases was the unsubstituted pyrazoloquinazolone aldehyde (XV). This may be explained as being due to diformylation of the 2-methyl group followed by internal attack of the acylamido nitrogen atom on the amidinium structure leading to the N-acyl derivative of the amidine (XXVIa and XXVIb) which undergoes hydrolysis during work-up to



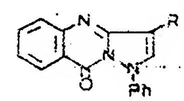
XXa,b
XXa (R = CH_3)
XXb (R = C_6H_5)



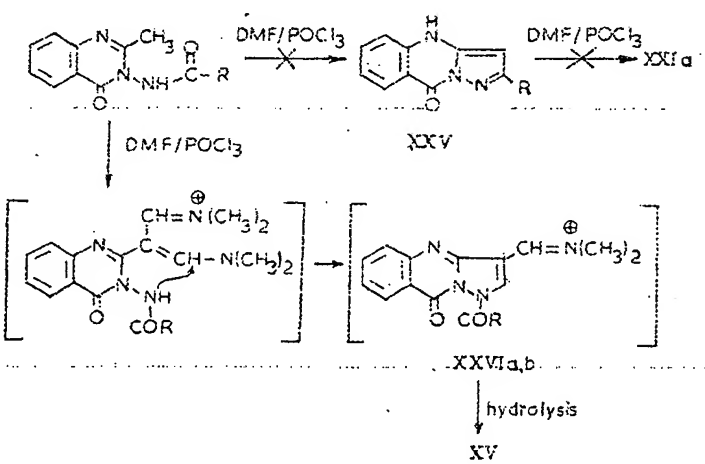
XXIa,b
XXIa (R = CH_3)
XXIb (R = C_6H_5)

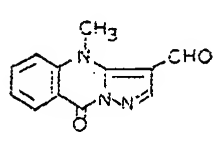


XXII

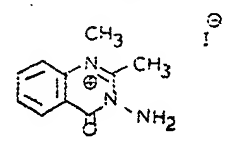


XXIII (R = H)
XXIVa (R = Br)
XXIVb (R = CN)





XXVII



XXVIII

yield XV. The identity of the products with XV was established by superimposable IR spectra and analysis.

Attempts were made to hydrolyse the reaction mixture to obtain the N-acyl derivative of XV to establish the proposed mechanism. However, all attempts to do this selectively failed. It is interesting to note that the acylamido derivatives could not be cyclized to the pyrazoloquinazolones (XXVa, b) by the usual cyclizing agents under various conditions.

An attempt was then made to synthesize a N-methylated derivative of XV. The aminoquinazolone (XIII) was quaternized[10] by methyl iodide and the quaternary salt (XXVIII) submitted to the Vilsmeier reaction with the object of getting the N-methyl derivative (XXVII). Surprisingly, the product of the reaction was the unsubstituted aldehyde (XV) as shown by its solubility in cold alkali and other physical properties. Apparently, the methyl group is lost at some stage, probably during the hydrolysis of the reaction mixture.

The Vilsmeier reaction was then carried out on 3-anilino-2-methylquinazolone (XXII) in order to obtain a N-phenyl derivative of XV. The product obtained was found to be the 1-phenylpyrazoloquinazolone (XXIII) and not the expected aldehyde. The structure of XXIII was shown from its basic character, analysis and its NMR spectrum. The NMR spectrum in $CDCl_3$ showed the 8H proton as the usual low field broadened doublet at 1·75 (J=8 Hz), two aromatic multiplets centred at 2·3 (2H and 5-H protons) and 2·67 (7 protons) and in addition a doublet at 3·58 (J=5 Hz) which apparently corresponds to the 3H proton, this assignment being confirmed by the study of the NMR spectrum of the bromo derivative described later.

The failure to obtain an aldehyde in this case may be attributed to the lower electron density in the 3 position on account of the presence of the phenyl substituent on the nitrogen atom. An attempt to introduce a nitrile function at the 3 position through the bromo derivative (XXIVa) to obtain the nitrile (XXIVb) failed because the bromo compound failed to react with cuprous cyanide under various conditions. The structure of the bromo compound as a 3-substituted derivative was established by its NMR spectrum in $CDCl_3$ which showed features similar to that of XXIII with the difference that the doublet due to 3H proton had disappeared.

Experimental Procedure

All melting points are uncorrected. IR spectra were recorded on a Perkin-Elmer model 21 spectrophotometer in nujol mull. Only relevant peaks are mentioned. NMR spectra were recorded on a Varian A-60 instrument (60 Hz/sec) with tetramethylsilane as the internal standard.

The compound (I) was prepared by the procedure of Singh and Chaudhary[2] and crystallized in colourless prismatic needles from ethanol, m.p. 148° (lit. m.p. 148°).

2-(*α-Dimethylaminomethylene-α-formylmethyl*)-3-*phenyl-4-quinazolone* (II) — To dimethylformamide (5 ml) cooled to 0° was added phosphorus oxychloride (1·2 ml, 3 moles) and the mixture left to stand for 10 min. To this was added with stirring the quinazolone (I, 1 g) dissolved in dimethylformamide (10 ml). The reaction mixture was heated at 75° for 4 hr and then poured into ice-cold water. The resulting clear solution was treated with solid sodium bicarbonate to *p*H 8 and extracted with benzene. The aqueous phase was treated with solid sodium carbonate to raise its *p*H to 9-10, boiled for half an hour and kept in a refrigerator overnight. The crystals of II thus obtained were filtered and recrystallized from benzene-pet. ether (40-60°), m.p. 228° (0·98 g). (Found: C, 71·8; H, 5·8; N, 13·2. $C_{18}H_{17}N_3O_2$ requires C, 71·5; H, 5·3; N, 13·2%).

2-(*α-Hydroxymethylene-α-formylmethyl*)-3-*phenyl-4-quinazolone* (III) — The acrolein II (1 g) taken in 5% aq. sodium hydroxide (10 ml) was heated (smell of dimethylamine) at 80° till a clear solution was obtained (20 min). It was then cooled, filtered and acidified. The solid (III) that separated was filtered, acidified and crystallized from aq. ethanol, yield 0·86 g; m.p. 204°. It was found to be insoluble in dil. HCl and gave brown colour with ferric chloride (Found: N, 9·4. $C_{17}H_{12}N_2O_3$ requires N, 9·6%).

Condensation of III *with primary and secondary amines* — To the dialdehyde III (1 g) taken in ethyl alcohol (10 ml) was added equimolar quantity of the amine and the mixture kept overnight. The solution was evaporated to dryness and the resulting residue crystallized from benzene-pet. ether (40-60°) to afford the following products: XIb, morpholino derivative (0·91 g), m.p. 216° (Found: N, 11·5. $C_{21}H_{19}N_2O_2$ requires N, 11·6%). XIa, N-methylpiperazino derivative (0·99 g), m.p. 186° (Found: N, 14·4. $C_{22}H_{22}N_4O_2$ requires N, 14·9%). XIc, anilino derivative (1·1 g), m.p. 158° (Found: N, 11·3. $C_{23}H_{17}N_3O_2$ requires N, 11·4%).

2-(4-*Pyrazolyl*)-3-*phenyl-4-quinazolone* (V) — To a solution of acrolein (II) or dialdehyde (III) (1 g) in ethanol (10 ml) was added an equimolar quantity of hydrazine sulphate. The reaction mixture was refluxed for 2 hr, cooled and added on to crushed ice. The precipitated yellow solid (V, 0·8 g) was filtered, washed thoroughly with water and crystallized from dioxane as yellow needles, m.p. 285° (decomp.) (Found: N, 18·9. $C_{17}H_{12}N_4O$ requires N, 19·4%).

2-(1-*Phenyl-4-pyrazolyl*)-3-*phenyl-4-quinazolone* (VI) — A mixture of acrolein (II, 1 g), phenylhydrazine (0·4 ml) and ethanol (10 ml) was refluxed for 2 hr. The reaction mixture was cooled and poured into water. The yellow ppt. (VI, 1 g) was filtered, washed with water, dried and crystallized from ethanol in yellow needles, m.p. 242° (Found: N, 14·4; C, 75·4; H, 4·0. $C_{23}H_{16}N_4O$ requires N, 15·4; C, 75·8; H, 4·0%). The analytical value of nitrogen was found to be consistently low in spite of repeated crystallizations from several solvents.

2-(4-*Isoxazolyl*)-3-*phenyl-4-quinazolone* (IV) — A mixture of II (1 g), hydroxylamine hydrochloride (0·2 g) and ethanol (10 ml) was refluxed for 2 hr. On cooling, the colourless plates of IV were separated (0·98 g) which were filtered, washed thoroughly with water and recrystallized from ethanol in colourless plates, m.p. 197°. The analytical value for nitrogen was found to be consistently low in spite of repeated crystallization from several solvents.

2-(*α-Formyl-α-cyanomethyl*)-3-*phenyl-4-quinazolone* (VII) — The isoxazole IV (1 g) taken in 5% aq. sodium hydroxide was heated on a hot water-bath till a clear solution was obtained (30 min).

It was then cooled and acidified with hydrochloric acid when a white solid (VII, 0·94 g) separated. It was filtered, washed thoroughly with water and crystallized from aqueous ethanol in colourless needles, m.p. 230° (Found: N, 14·3. $C_{17}H_{11}N_3O_2$ requires N, 14·5%); ν_{max}^{nujol} 2200 cm^{-1} (CN).

2-(5-*Amino-4-pyrazolyl*)-3-*phenyl-4-quinazolone* (VIII) — A mixture of VII (1 g) and hydrazine hydrate (80%, 0·4 ml) taken in acetic acid (10 ml) was heated at 100° for 2 hr. The reaction mixture was cooled, added onto crushed ice and basified with sodium bicarbonate to *p*H 8. The aminopyrazole (VIII) obtained as brown solid was filtered, washed thoroughly with water and crystallized from aqueous ethanol as pinkish brown needles, m.p. 295° (decomp.), yield 0·35 g (Found: N, 22·7. $C_{17}H_{13}N_5O$ requires N, 23·0%).

2-(1-*Phenyl-5-amino-4-pyrazolyl*)-3-*phenyl-4-quinazolone* (IX) — A mixture of VII (1 g), phenylhydrazine (0·3 ml) and acetic acid (10 ml) was heated at 100° for 1 hr. On cooling it was added on to crushed ice. The precipitated brown solid (IX) was filtered, washed thoroughly with water and crystallized from aq. ethanol in brown needles, m.p. 275° (yield 0·6 g). It was soluble in dil. HCl (Found: N, 17·9. $C_{23}H_{17}N_5O$ requires N, 18·4%).

2-(2-*Phenyl-5-pyrimido*)-3-*phenyl-4-quinazolone* (Xa) — To benzamidine hydrochloride (1 g) taken in absolute ethanol (5 ml) was added sodium metal (0·007 g) in small lots. The precipitated sodium chloride was removed by filtration. The filtrate was mixed with an ethanolic solution of the aminoacrolein II (1 g) and the mixture refluxed for 4 hr. On cooling pale yellow needles of Xa separated out (1·05 g) which were filtered and washed successively with ethanol and water and recrystallized from dioxane in pale yellow needles, m.p. >300° (Found: N, 14·4. $C_{24}H_{16}N_4O$ requires N, 14·9%).

12-*Ketoquino*[2,1-*b*]-*quinazoline-6-carboxaldehyde* (XII) — To polyphosphoric acid [from phosphorus pentoxide (4·5 g) and orthophosphoric acid (2 ml)] was added dialdehyde III (1 g). The mixture was heated to 130° for 2 hr. The clear pink solution so obtained was cooled and added into cold water when a bright yellow solid (XII) separated out. It was filtered, washed thoroughly with water, dried and crystallized from benzene (yield 0·65 g), m.p. 155° (Found: C, 74·6; H, 4·1; N, 10·3. $C_{17}H_{10}N_2O_3$ requires C, 74·4; H, 3·6; N, 10·2%).

3-*Amino-2-methyl-4-quinazolone* (XIII) — The amino methylquinazolone (XIII) was prepared by a slight modification of the procedure of Bogert *et al.*[8]. The acetanthranil (2-methyl-3,1,4-benzoxazone) was conveniently prepared by heating anthranilic acid with acetic anhydride. The acetanthranil was not filtered after the reaction but the acetic anhydride solution was evaporated to dryness under vacuum. The crude acetanthranil was treated with hydrazine hydrate (3 moles, 50%) in the cold, refluxed for half an hour, cooled and filtered. The solid (XIII) thus obtained was crystallized from ethanol. The anhydrous crystals of XIII melted at 152° (lit. m.p. 152°).

3-*Formyl pyrazolo*[5,1-*b*]*quinazolone* (XV) — To dimethylformamide (5 ml) cooled to 0° was added phosphorus oxychloride (2·7 ml, 5 moles) and the mixture left to stand for 10 min. XIII (1 g) dissolved in dimethylformamide (10 ml) was then added with stirring to the cooled reagent. The reaction mixture was heated at 70° for 5 hr and poured into crushed ice. The resulting creamy solution was basified with solid sodium bicarbonate to *p*H 8 in cold when a bright yellow crystalline compound separated out. It was filtered, washed with water and was found to be readily soluble in dil. acids. Its satisfactory elemental analysis could not be obtained as it was unstable. The compound was identified to be amidine (XIV) through its derivatives with *p*-nitroaniline (XVIIb) and *p*-chloroaniline (XVIIa).

The amidine (XIV) was taken in potassium carbonate solution (10%, 10 ml) and warmed at 60° for half an hour when a clear yellow solution was obtained. It was filtered to get rid of insoluble impurities. To the cooled filtrate was added acetic acid dropwise till it attained the *p*H of 5 when a yellow crystalline solid (XV) separated out. It was filtered, washed thoroughly with water, dried and crystallized from dioxane (yield 0·95 g), m.p. 280° (decomp.) (Found: C, 61·4; H, 3·6; N, 19·2. $C_{11}H_7N_3O_2$ requires C, 61·9; H, 3·3; N, 19·7%).

3-*Thioformyl pyrazolo*[5,1-*b*]*quinazolone* (XVa) — A reaction was performed as given in the above experiment. The reaction mixture was poured onto crushed ice and resulting creamy solution treated with sodium hydrogen sulphide to *p*H 9. The precipitated brown solid of XVa was filtered, washed with water, dried and crystallized from DMF (yield 0·9 g), m.p. >300° (decomp.) (Found: S, 14·3. $C_{11}H_7N_3OS$ requires S, 14·0%).

Pyrazolo[5,1-*b*]*quinazolone-3-aldoxime* (XVII) — The pyrazoloquinazolone aldehyde (XV, 1 g) and hydroxylamine hydrochloride (0·25 g) were taken in ethanol (10 ml) and refluxed for 3 hr. On cooling the reaction mixture, XVI was obtained as a yellow solid which was filtered, washed thoroughly with water, dried and crystallized from dimethylformamide as bright yellow amorphous powder (yield 1·0 g), m.p. >300° (Found: N, 24·0. $C_{11}H_8N_4O_2$ requires N, 24·5%).

Pyrazolo[5,1-*b*]*quinazolone-3-nitrile* (XVIII) — To a solution of pyrazoloquinazolone aldoxime (XVII, 1 g) in dry chloroform (10 ml) was added phosphorus oxychloride (0·5 ml) and the mixture refluxed for 2 hr. Chloroform was distilled off completely and ice-cold water added to the remaining semi-solid mass. Sodium bicarbonate was then added till the solution attained the *p*H of 8. The reaction mixture was stirred well when a pinkish solid (XVIII) started separating out gradually. After standing for half an hour it was filtered, washed thoroughly with water, dried and crystallized from DMF (yield 0·8 g), m.p. >300° (Found: N, 26·9. $C_{11}H_6N_4O$ requires N, 26·7%).

3-(2-*Cyano-2-carbethoxyvinyl*)-*pyrazolo*[5,1-*b*]*quinazolone* (XIX) — To a solution of pyrazoloquinazolone aldehyde (XV, 1 g) in ethanol (10 ml) were added ethyl cyanoacetate (0·5 ml) and piperidine (2 drops) and the mixture refluxed for 5 hr. On cooling a bright yellow compound (XIX, 1·1 g) separated out which was filtered and crystallized from DMF, m.p. >300° (Found: C, 61·7; H, 4·5; N, 17·6. $C_{16}H_{12}N_4O_3$ requires C, 62·2; H, 4·0; N, 18·1%).

Schiff's base of XV *with p-chloroaniline* (XVIIa) — A mixture of the amidine or the aldehyde (XIV or XV, 1 g), *p*-chloroaniline (0·5 g) and ethanol (10 ml) was refluxed for 1 hr, when a

yellow solid (XVIIa) separated out. The reaction mixture was cooled and filtered. The residue (XVIIa) was crystallized from ethanol in yellow needles (yield 1·15 g), m.p. >300° (Found: N, 17·0; Cl, 11·5. $C_{17}H_{11}N_4ClO$ requires N, 17·3; Cl, 11·0%).

Schiff's base of XV *with p-nitroaniline* (XVIIb) — A mixture of the amidine or the aldehyde (XIV or XV, 1 g), *p*-nitroaniline (0·5 g) and ethanol was refluxed for 1 hr, when a yellow solid separated out. The reaction mixture was cooled and filtered. The residue (XVIIb) was crystallized from ethanol as yellow needles (yield 1·1 g), m.p. >300° (Found: N, 21·3. $C_{17}H_{11}N_5O_3$ requires N, 21·0%).

Schiff's base of XV *with 3N,N-dimethylaminopropylamine* (XVIIc) — To a solution of pyrazoloquinazolone aldehyde (XV, 1 g) in ethanol (10 ml) was added 3-N,N-dimethylaminopropylamine (0·5 ml) and the mixture refluxed for 2 hr. Evaporation of ethanol followed by trituration with pet. ether (40-60°, 10 ml) precipitated a pink solid. It was filtered, washed with pet. ether (40-60°) and crystallized from benzene-pet. ether when pale pink needles, m.p. 170°, of XVIIc were obtained (yield 0·95 g) (Found: N, 23·1. $C_{16}H_{19}N_5O$ requires N, 23·5%).

The 2-methyl-3-anilino-4-quinazolone (XXII) was prepared according to the procedure of Grimmel *et al.*[9].

1-Phenyl-pyrazolo[5,1-*b*]*quinazolone* (XXIII) — Dimethylformamide (5 ml) cooled to 0° was mixed with phosphorus oxychloride (1·1 ml, 3 moles) and the mixture left to stand for 10 min. The anilinoquinazolone (XXII, 1 g) dissolved in DMF (10 ml) was added to the cooled reagent with stirring. The reaction mixture was then heated at 80° for 6 hr and poured into ice-cold water. The resulting creamy solution was basified with solid sodium carbonate to *p*H 9 and heated on a hot water-bath (90°) for 30 min. The yellow solid (XXIII) thus obtained was filtered, washed thoroughly with water, dried and crystallized from benzene (yield 0·8 g), m.p. 175° (Found: C, 73·1; H, 4·5; N, 15·6. $C_{16}H_{11}N_3O$ requires C, 73·5; H, 4·2; N, 16·0%).

3-Bromo-1-phenylpyrazolo[5,1-*b*]*quinazolone* (XXIVa) — A mixture of (XXIII, 1 g), N-bromosuccinimide (0·7 g) and DMF (10 ml) was heated at 100° for 4 hr. On cooling the reaction mixture was stirred into ice-cold water when a brown solid was precipitated. On crystallization from benzene it melted at 145°. It was chromatographed on neutral alumina and a single yellow band was eluted with benzene leaving behind impurities. Evaporation of benzene yielded pure XXIVa (0·6 g), m.p. 165° (Found: Br, 22·5. $C_{16}H_{10}N_3BrO$ requires Br, 23·5%).

(The more correct analytical value for bromine could not be obtained in spite of repeated crystallizations from several solvents.)

Acknowledgement

We are grateful to late Dr T. S. Gore and Prof. M. R. Padhye for the microanalyses and IR spectra respectively, to Dr K. Nagarajan (CIBA Research Centre, Bombay) for NMR spectra and the Maharashtra State Industrial Research Committee, Bombay, for the award of a JRF to one of us (R.S.P.).

References

1. CHANDRAMOHAN, M. R. & SESHADRI, S., *Indian J. Chem.*, **10** (1972), 573.
2. REID, J., SIEGLE, J. & CHRISTENSEN, E. C., in *Heterocyclic compounds*, edited by Weissberger (Wiley, New York), 1967, 50.
3. GUJRAL, M. L., SAXENA, P. N. & TIWARI, R. S., *Indian J. med. Res.*, **43** (1955), 637.
4. SINGH, B. D. & CHAUDHARY, D. N., *J. Indian chem. Soc.*, **45** (1968), 311.
5. LEONARD, N. L. & RUYLE, W. V., *J. org. Chem.*, **13** (1948), 903.
6. BOSE, P. K. & SEN, D. C., *J. chem. Soc.*, (1931), 2841.
7. KLUTCHKO, S., HANSEN, H. V. & MELTZER, R. I., *J. org. Chem.*, **30** (1965), 3454.
8. BOGERT, M. T., GORTNER, R. A. & MORGAN, J. F., *J. Am. chem. Soc.*, **31** (1909), 943.
9. GRIMMEL, H. W., GUENTHER, A. & MORGAN, J. F., *J. Am. chem. Soc.*, **68** (1946), 542.
10. BOGERT, M. T. & GREIGER, G. A., *J. Am. chem. Soc.*, **34** (1912), 683.